

# Predicting one's own death: the relationship between subjective and objective nearness to death in very old age

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**Abstract** Previous research found that the perception of a limited remaining lifetime is related to goal setting, social network composition, attitudes, and behavior. However, to better understand those findings, it is important to know if this subjective perception of being close to death corresponds with the time a person actually survives. The aim of the present study was to examine the predictive and time–dynamic relationship between subjective and objective nearness to death using 16-year longitudinal data from the Berlin Aging Study (Baltes and Mayer 1999;  $N = 516$  older adults between 70 and 104 years). Older adults who felt close to death at the first measurement occasion were more likely to die over the following 16 years than persons who did not report feeling close to dying. Results of multilevel analyses revealed that there was a time–dynamic relationship such that subjective nearness to death increased as a function of objective nearness to death. Our results indicate that very old adults seem to have quite accurate perceptions of their nearness to death.

**Keywords** Subjective nearness to death · Future time perspective · Berlin aging study · Mortality

## Introduction

How long am I going to live? Will I die soon? Those are questions that probably many people ask themselves from time to time, especially in old age. But can individuals really estimate how close they are to dying? The present study addresses this question by analyzing data from older adults who participated in the longitudinal Berlin Aging Study (BASE; Baltes and Mayer 1999) and died over the course of a 16-year assessment period.

Researchers in multiple disciplines have been interested in individuals' perception of their remaining lifetime. Economists, for instance, examine *subjective longevity expectations* (i.e., the subjective probability to survive to a certain age) to understand risk perception and decision making (e.g., choice of retirement age, purchase of life insurance), whereas psychologists pay particular attention to the psychological correlates and consequences of *subjective nearness to death* (i.e., feeling close to death). The relevance of being aware of one's finitude has been highlighted in several psychological theories. We here provide a brief summary of the most prominent theoretical approaches and empirical findings regarding the psychology of subjective closeness to death.

In lifespan developmental psychology, the perception that one's life is coming to an end is operationalized, among others, in the concept of future time perspective, which has received particular attention in the context of socio-emotional selectivity theory (SST; Carstensen 2006). This theory proposes that a limited future time perspective (i.e., feeling close to death) is predictive in the immediate

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and short term of shifting one's focus from knowledge-related goals to emotional goals and emotionally rewarding social interactions (Lang 2000). Those effects are observed particularly in older adults because they are more likely than younger adults to experience their remaining lifetime as limited (Lang and Carstensen 2002). Based primarily on notions of self-regulatory theories, Brandtstädter and Rothermund (2003) stress the importance of time as an action resource and a source of meaning. The authors suggest that when only a limited residual lifetime remains, the future consequences of actions may be questionable and individuals are therefore likely to shift their goals and value orientations. This theoretical assumption has been supported by a series of studies demonstrating that the experience and awareness that one's lifetime is running out leads to a shift from extrinsic-instrumental strivings to intrinsic or ego-transcending goals (Brandtstädter et al. 2010).

Whereas SST and the approach by Brandtstädter et al. (2010) mainly focus on the goal-related effects of perceived residual lifetime, Terror Management Theory suggests that being reminded of one's own mortality has many more psychological consequences. A variety of studies support this proposition, showing that mortality salience influences individuals' attitudes, values, and behavior (e.g., Maxfield et al. 2007; Pyszczynski et al. 2004). With advancing age, older adults experience a variety of negative physical and psychological changes such as increasing health problems, poorer memory performance, or loss of loved ones (e.g., Baltes and Smith 2003). It can be assumed that those age-related changes as well as the perception of being close to death may serve as constant reminders of mortality in old age, making older adults more prone to the effects of mortality salience. Along the same line, studies show that young people consider older adults to be "a living symbol of time running out" (Martens et al. 2004, p. 1534). Similar to the terror management approach, King et al. (2009) demonstrated that when the scarcity of life is highlighted through reminders of death, individuals evaluate life as more valuable.

Given that the subjective estimation of being close to death has many (psychological) consequences, the question arises whether this subjective estimation is accurate. In fact, the answer to that question might be of interest not only for psychologists but also for health professionals and economists. There is empirical evidence that the subjective probability of surviving to a specific age does correspond with actuarial estimates for age-specific mortality rates (Mirowsky 1999) and predicts mortality (e.g., Smith et al. 2001; van Doorn and Kasl 1998). It should be taken into account, however, that individuals' subjective closeness to death may not just be determined by their subjective probability of surviving to a specific age but also by the age

they desire to reach. In this context, Lang et al. (2007) have shown that for some individuals, high personal longevity expectations do not necessarily imply the actual desire to live that long, whereas others want to live longer than they actually expect.

In the present study, we extend previous research by investigating the relationship between subjective and objective nearness to death over a long time period and in a time-dynamic way. First, we hypothesize that subjective nearness to death predicts older adults' mortality risk over a 16-year period, suggesting that older adults have relatively accurate perceptions of their remaining lifetime. Second, we expect that subjective nearness to death changes as a function of objective nearness to death, that is, the closer individuals are to their actual death, the closer they feel to death. The examination of the time-dynamic relationship between subjective and objective nearness to death (as opposed to the more static approach in the first research question) is of interest because it addresses the question whether individuals accurately adjust their subjective perception of being close to death in line with the objective reduction of survival time. This is of particular interest considering that many studies now show that objective distance to death provides a better description of change trajectories in very old age than does age or time in study (e.g., Bosworth et al. 1999; Gerstorf et al. 2008). Given their advanced ages, one might assume that older adults always (i.e., irrespective of their actual nearness to death) report feeling close to dying. However, we expect that there are interindividual differences and intra-individual changes in older adults' subjective nearness to death that can be explained by participants' objective closeness to death.

## Method

### Participants and procedure

We used 16-year longitudinal data from the Berlin Aging Study. Detailed descriptions of the study design and multidisciplinary data protocols are published elsewhere (Baltes and Mayer 1999; Smith and Delius 2010).

At the first measurement occasion (T1), the sample consisted of 516 persons aged 70–103 years (mean age = 84.92 years, SD = 8.66), stratified by age and gender with 43 men and 43 women in each of six age brackets (70–74, 75–79, 80–84, 85–89, 90–94, 95+ years). For recruitment, 1,908 individuals were randomly drawn from the Berlin city registry and asked to participate. Of those, 928 persons took part in the Intake Assessment. Of those 928 persons, a total of 516 individuals completed the intense assessment protocol consisting of 14 sessions (each lasting about

90 min) covering multiple disciplines (e.g., psychology, sociology, psychiatry). Trained interviewers and medical personnel conducted individual face-to-face testing sessions which, except for medical examinations, took place at the participant's place of residence (private home or institution). Participants received 50 Deutsche Mark/25 Euro (\$25/\$30) for their participation in each session.

We obtained information about mortality status and date of death for deceased participants in March 2007 from the Berlin city registry. About 16 years after the beginning of the study, 439 persons were deceased and 57 (11%) survived. Mortality information was missing for 20 participants who had moved out of the Berlin area.

Our survival analyses covered a 16-year period and included the BASE survivors and decedents ( $N = 496$  excluding missing information on survival). For analyses of change in subjective nearness to death over distance to death, we used data collected over five measurement occasions and included *only* persons who had died between the first measurement occasion (T1, 1990–1993) and the mortality update in March 2007 ( $N = 439$ ). The average age of death of the deceased participants was 91.67 years ( $SD = 7.04$ , range 73–106 years). Data for subjective nearness to death were available for the following number of deceased participants: T1 (1990–1993):  $N = 438$ ; T3 (1995/96):  $N = 152$ ; T4 (1997/98):  $N = 87$ ; T5 (2000):  $N = 44$ ; T6 (2004/05):  $N = 12$ .<sup>1</sup> Longitudinal sample attrition was primarily due to mortality. Only about 10% of participants dropped out voluntarily at each measurement occasion, primarily because of poor objective health.

## Measures

*Subjective nearness to death* was assessed with a single item (I have the feeling that my time is running out) on a 5-point scale (1 = “does not apply to me at all,” 5 = “applies very well to me”). High scores are indicative of feeling close to death. At baseline, the mean subjective nearness to death score for the full sample was 2.84 ( $SD = 1.28$ ;  $N = 515$ ) and 2.93 ( $SD = 1.29$ ) for the subsample of participants who died ( $N = 438$ ) in the subsequent years.

## Covariates

The following variables known to predict mortality were used as time-invariant covariates: *age* (centered at 85 years), *gender* (0 = men and 1 = women), *socioeconomic status* (SES: unit-weighted composite including years of education, household income, and occupational

prestige; cf. Mayer et al. 1999), and *comorbidity/objective health* (number of physician-determined medical diagnoses of moderate to severe chronic physical illnesses). The diagnoses of physical illness were based on standardized physical examinations, medical information obtained from the family doctor, medication information, and pathology findings (Steinhagen-Thiessen and Borchelt 1999). Compiled information about each participant was discussed in case-by-case conferences between the BASE physicians and psychiatrists to reach consensus about the final diagnoses. In addition to the time-invariant covariates, we used cognitive functioning and subjective health, assessed from T1 to T6, as time-varying covariates. *Cognitive functioning* is a unit-weighted composite score (second-order factor) that represents five intellectual abilities (first-order factors: perceptual speed, reasoning, memory, knowledge, fluency) assessed with 14 cognitive tasks (Lindenberger and Baltes 1997). *Subjective health* was assessed on a 5-point scale with the item “How would you rate your present physical health”? High scores indicate high levels of subjective health.

## Results

To test our first research question whether subjective nearness to death at baseline predicted mortality risk 16 years later, we conducted Cox proportional hazard models using SPSS 16. In a first model ( $N = 496$ ), subjective nearness to death at baseline (1990–1993) was the predictor and mortality status (deceased vs. alive in March 2007) was the criterion. Confirming our hypothesis, we found that individuals who reported feeling close to death at baseline had an increased risk of dying over the following 16 years, Relative Risk (RR) = 1.27,  $p < 0.001$  (cf. Table 1, Model 1). Figure 1 illustrates this effect, with the Kaplan–Meier survival functions for people who felt near versus far from death (based on median split). Individuals who reported feeling close to death at baseline had a median survival time of 3.63 years, whereas those who did not feel close to death survived on average 6.06 years,  $\chi^2(1, N = 496) = 53.70$ ,  $p < 0.001$ . More precisely, 16% of those who did not feel close to death were still alive 16 years later. The same was true for only 3.8% of the individuals who reported high nearness to death at the first measurement occasion.

In a second Cox regression analysis, we tested whether the finding was robust to statistical controls for common determinants of mortality in old age (chronological age, gender, SES, cognitive functioning, objective health, subjective health). As Model 2 in Table 1 illustrates, subjective nearness to death did not remain a significant predictor of mortality risk,  $RR = 1.07$ ,  $p = 0.12$ . This drop

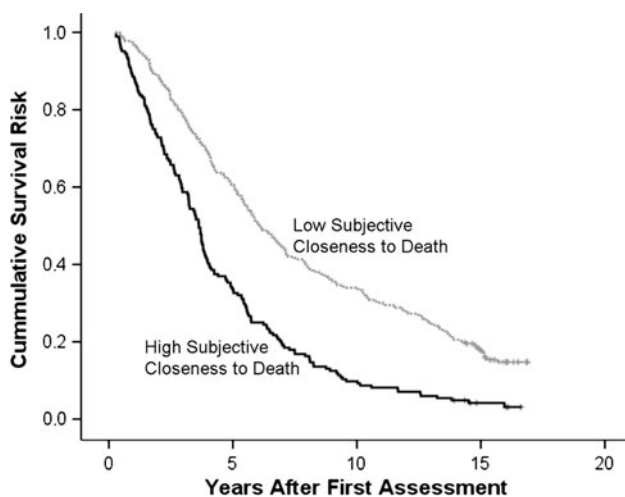
<sup>1</sup> Due to a shortened assessment protocol, no data was available for T2.

**Table 1** Subjective nearness to death as a predictor of mortality risk

Risk variable	Model 1: without covariates	Model 2: with covariates
Subjective nearness to death	1.27*** [1.18–1.38]	1.07 [0.98–1.16]
Age	–	1.08*** [1.07–1.10]
Gender	–	0.61*** [0.50–0.75]
SES	–	1.01 [0.99–1.02]
Cognitive functioning	–	0.97*** [0.96–0.98]
Comorbidity (objective health)	–	1.03*** [1.02–1.04]
Subjective health	–	0.91* [0.83–0.99]
$\chi^2$	39.05***	300.68***
$-2LL$	4760	4477

Note: Risk ratios and confidence intervals (in brackets) are reported.  $\chi^2$  and  $-2LL$  ( $= -2$  Log Likelihood) are reported as model fit statistics. For the  $\chi^2$  tests,  $N = 495$ ,  $df = 1$  for Model 1,  $df = 7$  for Model 2. Gender is coded as 0 = men, 1 = women. SES and cognitive functioning are composite scores with higher values representing higher SES or cognitive functioning, respectively. Comorbidity is indexed by the number of physician-rated medical diagnoses of moderate to severe chronic physical illnesses

\*  $p < 0.05$ , \*\*\*  $p < 0.001$



**Fig. 1** Relationship between subjective nearness to death and survival probability. Participants who did not feel close to death at the first measurement occasion (grey, dotted line) had a higher survival probability over the 16-year assessment period than participants who felt close to death (black, solid line). The marks at the end of each line represent censored data

in predictive power seems to be due to the joined forces of the two health measures (subjective and objective health). When only one health indicator (subjective or objective health) was included in the analysis, the effect of subjective nearness to death on mortality remained (marginally) significant: effects for subjective nearness to death when age, SES, gender, cognitive functioning, and objective health

are included:  $RR = 1.08$ ,  $p = 0.056$ ; effects for subjective nearness to death when age, SES, gender, cognitive functioning, and subjective health are included:  $RR = 1.08$ ,  $p = 0.047$ ). As expected and in accordance with many other studies, we found that higher age, lower cognitive functioning, both low objective and subjective health, and being male were also related to higher mortality risk in our sample (cf. Table 1, Model 2).

The analytical approach for our second research question was more time-dynamic in that it tested whether subjective nearness to death increased when people approached their actual death. That is, we related change in subjective nearness to death to change in objective nearness to death in the decedent sample. In this approach, we applied multilevel modeling using SAS PROC MIXED (Littell et al. 1996), with incomplete data being treated as missing at random (Little and Rubin 2002).<sup>2</sup> We first tested a fully unconditional model which revealed that 51% of the variation in subjective nearness to death was within-person variance with the remainder being between-person variance. We then tested a random coefficient regression model with distance to death as the time-varying covariate (level 1 predictor).<sup>3</sup> In Table 2 (Model 1), the fixed effects estimate for the intercept indicates that the average subjective nearness to death score was 3.25 (on a 5-point scale with 1 = not close to death at all, 5 = very close to death) when objective distance to death was 0 years. The significant fixed effects estimate for the slope indicates that, consistent with our hypothesis, subjective nearness to death increased by 0.07 points for each year approaching death. Specifically, over a maximum period of 16 years, subjective nearness to death increased by  $0.07 \times 16 = 1.12$  points (i.e., 16 years prior to death, the average subjective nearness to death score was  $3.25 - 1.12 = 2.13$ ). The significant random effect of the intercept and the nonsignificant random effect of the slope indicate that individuals differed in their level but not their change trajectories of subjective nearness to death.

We also tested for non-linear trajectories by entering the quadratic term or the quadratic and cubic terms of distance to death as level 1 predictors in our model (in addition to the linear term). Whereas the linear term remained significant, neither the quadratic nor the cubic term of distance to death was a significant predictor of subjective nearness to death, all quadratic or cubic slopes  $< 0.001$ , all  $ps > 0.46$ .

<sup>2</sup> We acknowledge that—as it is generally the case for longitudinal studies that use distance-to-death as a time metric—data incompleteness was not completely missing at random (i.e., due to mortality; but see Schafer and Graham 2002, who suggest that missing at random procedures may be applicable in such cases). This may have reduced the variance as well as the covariance of our variables.

<sup>3</sup> Objective nearness to death explained 6% of the within-person variance in subjective nearness to death ( $R^2_{\text{within}} = 0.058$ ).

**Table 2** Linear growth models for subjective nearness to death over distance to death

Parameter	Model 1: without covariates		Model 2: with covariates	
	Estimate	SE	Estimate	SE
<b>Fixed effects estimates</b>				
Intercept	3.25***	(0.08)	3.10***	(0.33)
Slope (Change as a function of distance to death)	0.07***	(0.01)	0.04**	(0.01)
Cognitive functioning <sup>a</sup>			0.01	(0.01)
Subjective health <sup>a</sup>	–	–	–0.21***	(0.04)
Age			0.04***	(0.01)
Gender	–	–	0.23*	(0.10)
SES	–	–	0.01	(0.01)
Comorbidity (objective health)		–	0.01	(0.01)
<b>Random effects estimates</b>				
Variance intercept	0.86***	(0.18)	0.69***	(0.13)
Variance slope	0.00	(0.21)	0.00	(0.00)
Covariance intercept, slope	0.01	(0.02)	0.01	(0.01)
Residual variance	0.76***	(0.07)	0.77***	(0.07)
AIC	2,295		2,219	
–2LL	2,283		2,197	

Note: Unstandardized estimates and standard errors are presented

AIC Akaike Information Criterion; –2LL –2 Log Likelihood, relative model fit statistics. Gender is coded as 0 = men, 1 = women. SES and cognitive functioning are composite scores with higher values representing higher SES or cognitive functioning, respectively. Comorbidity is indexed by the number of physician-rated medical diagnoses of moderate to severe chronic physical illnesses

<sup>a</sup> Cognitive functioning and subjective health are time-varying covariates whereas age, gender, SES, and comorbidity are time-invariant covariates

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

In a second multilevel model, we again used distance to death as a time-varying covariate. In addition, we entered baseline measures of age, gender, SES, and comorbidity as potential time-invariant covariates (level 2 predictors) and longitudinal measures of subjective health and cognitive functioning as potential time-varying covariates (level 1 predictors). In this model, the effect of distance to death on subjective nearness to death remained robust (Table 2, Model 2), that is, subjective nearness to death declined as individuals approached death, intercept = 3.10 (SE = 0.33), slope = 0.04 (SE = 0.01), both  $ps < 0.01$ . Again, the random effect of the slope was not significant indicating that participants did not differ in their change trajectory of subjective nearness to death. The significant random effect of the intercept revealed that there were interindividual differences in the level of subjective nearness to death. About 12% of those interindividual differences in level could be explained by the covariates used in this

model. Specifically, both a higher age at the first measurement occasion and being female were related to higher subjective nearness to death. Furthermore, the significant effect of the time-varying covariate subjective health indicated that when subjective health decreased subjective nearness to death increased.

## Discussion

Prominent psychological theories such as Terror Management Theory (Greenberg et al. 1990) or SST (Carstensen 2006) have emphasized the importance of individuals' awareness of being close to death. Specifically, studies have shown that the perception of one's lifetime as limited is a crucial explanatory factor in the context of motivational and social processes (e.g., Brandtstädter et al. 2010; Lang 2000; Mirowsky 1997; Ziegelmann et al. 2006): Depending on the perception of their remaining lifetime, individuals may adjust the choices they make, the health behaviors they practice, the type of goals they pursue or the social relationships they focus on. Feeling close to death can even increase the perceived value of life (King et al. 2009). In the present study, we addressed the question whether this subjective perception that one's time is running out matches the fact of actually being close to death. Confirming our expectation, two sets of results demonstrate that subjective nearness to death is in fact related to objective nearness to death in old and very old age.

First, we found that subjective nearness to death predicted mortality risk up to 16 years later. More specifically, older adults who did not feel close to death at the first measurement point lived on average 2.5 years longer and had a higher probability of being alive 16 years later than those who felt close to death. This is in accordance with findings from previous studies showing that the subjective expectation to survive to a certain age predicts mortality risk (Smith et al. 2001; van Doorn and Kasl 1998). Most importantly, this result suggests that, at least in very old age, subjective nearness to death to some extent matches objective closeness to death, indicating that older adults might have relatively accurate perceptions of their remaining lifetime. Second, we found that changes in subjective nearness to death were related to changes in objective nearness to death. More precisely, for each year participants approached death, their subjective nearness to death increased as well. It should be emphasized that the relationship between subjective and objective nearness to death was linear rather than non-linear in nature. This implies that there are no discontinuous shifts in the subjective perception of one's nearness to death, which would have been indicative of terminal decline (i.e., a more pronounced change at any point as individuals approach death).

Thus, the linear model suggests that over a large time span of old age, individuals accurately adjust their subjective nearness to death as their remaining lifetime declines. It should be noted, however, that even though there were interindividual differences in participants' estimated subjective distance to death, the average score at time of death was 3.25 (on a 5-point scale, 5 = feeling very close to death). This finding slightly attenuates conclusions regarding older adults' accuracy in estimating their closeness to death.

Interestingly, the static (Cox regressions) and time-dynamic (multilevel analyses) examinations of the relationship between subjective and objective nearness to death yielded somewhat different result patterns when we controlled for potential covariates. Although subjective nearness to death remained a significant predictor of mortality risk after controlling for age at first measurement point, gender, SES, and cognitive functioning, we found that the additional control for both subjective and objective health rendered the effect of subjective nearness to death on mortality nonsignificant. This result suggests that subjective nearness to death has no relationship to death after controlling for health. This is consistent with much research showing that both subjective and objective healths are important predictors of mortality (e.g., Idler and Benyamini 1997) and it could be speculated that the information contained in subjective nearness to death is already contained in either objective or subjective health.

In contrast to the results of the Cox regressions, however, the results of the multilevel analyses provide evidence that subjective nearness to death is related to death even when controlling for the effects of health. Specifically, when including subjective health as a time-varying covariate and objective health as a time-invariant covariate, subjective nearness to death still showed significant linear change as a function of objective nearness to death. This finding suggests that the subjective perception of being close to death is not just a reflection of individuals' health or the perception of their health, as it would appear if we only considered the results of the Cox regression analysis. Clearly, there is an association between subjective nearness to death and subjective health (as evidenced by the finding that a decrease in subjective health is linked to an increase in subjective nearness to death) but both constructs have their own information value.

Even though the survival analyses used in this study represent an important and informative first step in investigating the long-term relationship between subjective and objective nearness to death, we believe that the multilevel model provides a more accurate representation of this relationship because it uses more data points and estimates the time-related process by linking changes in both variables to each other. In this regard, our findings also

underline the importance of using statistical methods that make use of the most available information.

Our finding that subjective nearness to death is related to objective nearness to death even after controlling for other variables is in line with a growing number of studies showing that subjective evaluations (e.g., well-being, self-perceptions of aging, personality) have predictive power over and above the effects of common objective determinants of mortality such as age or objective health status (e.g., Chida and Steptoe 2008; Kotter-Grühn et al. 2009; Mroczek and Spiro 2007). However, when interpreting the results of the multilevel analysis, it should be taken into account that distance to death as a time metric only explained some of the within-person variance in subjective nearness to death (comparable to a small- to medium-sized effect). Similarly, the time-invariant and other time-varying covariates only explained some of the between- and within-person variance in subjective nearness to death. This means that a large portion of variance in subjective nearness to death is still unexplained. Future research would benefit from a detailed investigation of other predictors of interindividual differences in level and change in subjective nearness to death.

How do older adults know they are approaching death? Of course, there is a logical relationship between getting older and being closer to death. Thus, it is to be expected that older adults report feeling closer to death as time goes by. However, in the present study, we controlled for chronological age and still found that subjective nearness to death was (a) a predictor of mortality and (b) changed as a function of objective nearness to death. So far we can only speculate about this relationship between subjective and objective nearness to death. First, it might reflect individuals' ability to predict their own death. When estimating their closeness to death, individuals may take into account a variety of factors that are indicative of approaching death and that may help them to come to a relatively accurate estimation. For instance, they may consider their age, their health, maybe even familial risk factors or the age at which parents, siblings, or friends died as reference points (cf. Hurd and McGarry 2002). They may also think about the symptoms that friends or relatives showed shortly before dying and compare themselves to those persons. Furthermore, individuals' will to live, their valuation of life (Lawton et al. 2001), or the desire to live to a certain age (cf. Lang et al. 2007) might be reflected in the personal estimation of subjective nearness to death. Overall, such influencing factors are likely to be person-specific and therefore difficult to identify.

The idea that individuals may take into account their age or subjective health status when estimating their closeness to death is supported by our finding that both variables accounted for interindividual differences in the level of subjective nearness to death. As can be expected,

individuals with a higher age or worse subjective health felt closer to death than persons who were relatively younger and subjectively healthier. Furthermore, when subjective health decreased subjective nearness to death increased. These results are similar to those of studies showing that a higher age and poor health are predictive of lower levels of valuation of life in old and very old age (Jopp et al. 2008; Lawton et al. 2002). Of interest is the seemingly contradictory finding that although men are likely to die earlier than women (as indicated by a significant effect of gender in the survival analysis) yet, compared to women, they report feeling less close to death (as indicated by a significant effect of gender in the multilevel analysis). A similar pattern had emerged in one of our previous studies for self-perceptions of aging (Kotter-Grühn et al. 2009). One possible explanation is that men in comparison to women evaluate their health more positively and also suffer fewer chronic functional limitations (Baltes et al. 1999). If individuals use their subjective health status to estimate their remaining lifetime, this positive perception of their health might make men more likely to come to more positive (under-) estimations of their nearness to death. In addition, men might have a general bias to rate their situation more positively than women do.

The relationship between subjective and objective closeness to death might further be indicative of a self-fulfilling prophecy. That is, those who believe that their time is running out might die earlier because of this belief; they simply ‘give up’ or lose the will-to-live. In contrast to those who give up, some individuals might never report feeling close to death, which would be in line with the notion that, in general, people suppress or avoid death-related thoughts (Goldenberg and Arndt 2008). This could represent either a form of denial (i.e., not being able or willing to admit to oneself that one’s time is running out) or optimism, which, in turn, may be adaptive in that this positive attitude contributes to longer survival (cf. Seligman 2000). In this regard, for some people, finally admitting to themselves that their time is running out is perhaps a sign of deteriorating self-regulatory functions, most likely due to a biological decline.

### Limitations and future outlook

Our research involved a locally representative sample of old and very old adults. We assume that our findings generalize to the population over age 70 but consider it unlikely that younger- or middle-aged adults could equally well predict their nearness to death (unless they are terminally ill with a specific lifetime prognosis).

One limitation of this study is the assessment of subjective nearness to death with a single item (asking

participants whether their time is running out). The advantage of the current approach is that it is left to the interpretation of the participant what “time running out” means for him/her. However, when interpreting our findings, it remains open what temporal reference point participants used to respond to the question whether their time is running out. An alternative assessment technique could be to ask persons to estimate a number of years still to live. This approach would be easier to quantify and therefore more precise but it would not necessarily reflect participants’ subjective perception and evaluation of their remaining time and/or closeness to death. Indicating that one’s time is running out can have positive and negative meanings for different people. For example, an 85-year-old person might estimate that he/she has 5 more years to live. Whereas one person might think he/she has *only* 5 years left, another person might think he/she has *still* 5 years left. Thus, even with comparable subjectively estimated remaining lifetimes, the individuals’ perceptions of this time can differ. Consequently, although this was not feasible in the context of the large scale longitudinal assessment protocol of the Berlin Aging Study, a combination of different assessment techniques may be most effective. Specifically, the usage of more specific items asking for an estimation of the number of years still to live, whether this remaining time is perceived as long or short, positive or negative, and which indicators were used to come to this conclusion could help disentangle the processes involved in accurately estimating one’s closeness to death.

Finally, admitting to oneself that one is close to dying is likely to be influenced by one’s general acceptance of and attitudes toward death (cf. Neimeyer et al. 2004). In this context, future research should explore the static and longitudinal/time-ordered associations between death attitudes or fears and subjective as well as objective nearness to death. Death attitudes or the will to live might account for or qualify the relationship between subjective and objective nearness to death that was found in the present study.

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